

### **REMARKS**

Applicants note with appreciation the indication of allowable subject matter in the present application, specifically, Claims 1-17 and 19-29. Now in the application are Claims 1-17 and 19-38 of which Claims 1, 30, and 35 are independent. Applicants contend that Claims 1-17 and 19-38 are patentable and in condition for allowance as discussed below.

#### **Claim Rejections under 35 U.S.C. § 103**

The Office Action rejects Claims 30-32 and 35-38 as being unpatentable over U.S. Patent No. 6, 542,846 of Miller *et al.* (hereinafter “Miller”) in view of U.S. Publication No. 2001\0021217 (hereinafter “Gunther”). Applicants respectfully traverse each of these rejections on the basis of the following arguments and further contend that neither Miller nor Gunther, alone or in combination, teach or suggest all elements of these claims, as described below, and hence, does not detract from the patentability of these claims.

For purposes of clarity in the discussion below, the respective claim sets rejected under 35 U.S.C. § 103 are discussed separately.

##### **A. Rejection of Claims 30-32 under 35 U.S.C. §103(a):**

The Office Action rejects Claims 30-32 as being unpatentable over Miller in view of Gunther. Applicants respectfully traverse this rejection on the basis of the following arguments, and further contend that neither Miller, nor Gunther, alone or in combination, establish a *prima facie* case of obviousness, as described below, and hence not detract from the patentability of the claimed invention.

Claims 31 and 32 depend from Claim 30, and thereby incorporate the patentable features of Claim 30.

Claim 30 recites a controller for monitoring die temperatures of an integrated circuit. The controller includes means for receiving a plurality of first values representative of a plurality of die temperatures of the integrated circuit and means for comparing the plurality of first values to a plurality of corresponding second values representative of a plurality of threshold values. The controller further includes means for determining whether an over temperature condition of the integrated circuit exists based on an output of the means for comparing.

The Miller patent describes a thermal management system for a portable ultrasound imaging device. The thermal management system of Miller includes a number of temperature sensors, preferably thermistors to monitor respective case temperatures of the components forming the portable ultrasound imaging device. A thermal management controller periodically polls the temperature sensors during operation of the ultrasound system according to a software polling routine stored in the thermal management controller. The thermal management system of Miller monitors the respective case temperatures of various system components, for example, a battery, a fan, a package surface of an integrated circuit, and, based on the monitored temperatures, performs control to cool the ultrasound system to maintain an external casing temperature below safety regulated temperatures. In this manner, a patients' safety is maintained so that the external surface temperature of the imaging device does not exceed 50°C. That is, the Miller patent solves a problem with high external surface temperatures of a portable ultrasound probe to avoid discomforting or harming a patient when the external surface of the probe contacts the skin of a patient or user.

The cited Gunther reference is concerned with an integrated on-chip thermal management system providing closed-loop temperature control of an integrated circuit device. Gunther describes thermal management system that includes: 1) a temperature detection element including at least one thermal sensor; 2) a power modulation element; 3) a control element; and 4) a visibility element. The thermal sensor includes a programmable voltage source and a reference voltage source, both of which are powered by a current source. The thermal sensor of Gunther further includes a comparator, also powered by the current source. A transmission medium couples the programmable voltage source to the comparator and similarly, a transmission medium couples the reference voltage source to the comparator, which includes an output. The reference voltage source of the thermal sensor provides a relatively constant voltage to the comparator over a temperature range of interest. The programmable voltage source of the thermal sensor generates a voltage value dependent upon the temperature of the die area in the vicinity of the thermal sensor. The comparator of the thermal sensor compares the voltage value from the programmable voltage source against the voltage value from the reference voltage source and, if the programmable voltage value equals or exceeds the reference voltage value, the comparator provides a high logic level (i.e., a logical 1) on its output; otherwise, the comparator provides a low logic level (i.e., a logical 0) on its output. The Gunther reference seeks to solve a

number of problems associated with thermal management of an integrated circuit die, for example, the detection of “hot spots” that cause uneven heating of the die. *See*, paragraph 5 of Gunther.

The cited references, alone or in combination do not detract from the patentability of Claim 30. The Miller patent teaches an analog based thermal management system for a portable battery powered ultra sound device to avoid burning the skin of a patient. The system of Miller is meant to prevent the external surface temperature of the device from exceeding a temperature defined by critical medical safety regulation requirements. The Miller patent teaches the use of thermistors or passive thermal sensors to perform a surface or case temperature measurement of the various units that form the portable battery powered ultra sound device. As recognized by the Examiner, the Miller patent does not teach or suggest a controller for monitoring *die* temperatures of an integrated circuit that includes amongst other features, a means for receiving a plurality of die temperature values, as recited in Claim 30.

The Examiner looks to the Gunther reference to overcome the factual deficiency of the Miller patent. That is, the Examiner cites the Gunther reference for teaching or suggesting an on-chip thermal management system which has the functionality for monitoring die temperatures of an integrated circuit. However, the Gunther reference teaches digital based thermal management system having a structure and a function and an operation different from the system taught by Miller. That is, the system of Gunther includes a thermal sensor that asserts a digital output. Nevertheless, the Gunther reference fails to teach or suggest a controller for monitoring *die* temperatures of an integrated circuit that includes amongst other features, a means for comparing a plurality of first values to a plurality of corresponding second values representative of a plurality of threshold temperatures, as recited in Claim 30.

In contrast to Gunther, Miller teaches a thermal management system with a comparator outside of an analog based thermal sensor. The Miller patent teaches a thermal management system that requires analog-to-digital converters in order for the thermal management controller to read an output of a thermal sensor. Hence, the Gunther reference teaches a digital thermal sensor and system having a structure and function and operation different from the structure, function, and operation of the analog thermal sensor and system taught by the Miller patent. Because the Gunther reference teaches a digital thermal sensor and system having a structure and a function and an operation different the analog thermal sensor and system taught by the Miller

patent, the proposed combination would require a substantial redesign and reconstruction of the analog thermal sensor and thermal system taught by Miller to operate and function in conjunction with the digital thermal sensor and system taught by Gunther.

More specifically, the Miller patent teaches a controller that requires polling of various temperature sensors according to a software polling routine to read a temperature sensed by a temperature sensor. *See*, Column 4, lines 36-42 of Miller. The temperature sensor of Miller in response to receipt of the poll sends an analog temperature value to the controller. In contrast to Miller, the thermal sensors taught by Gunther are event driven devices and are not responsive to a polling request. That is, the controller taught by Gunther does not poll the thermal sensors. The digital thermal sensors of Gunther either assert a logical “0” or a logical “1” and a change in the output state of the digital thermal sensor taught by Gunter operates and functions as an interrupt to automatically report an over temperature event to the controller. Thus, a change in an output state of the digital thermal sensor taught by Gunther acts as an interrupt to indicate a temperature value crossed a threshold and does not indicate an actual temperature value of the die in the vicinity of the thermal sensor. Furthermore, the controller of Miller performs the comparison of the polled temperature value to the reference value to determine an over temperature condition while the thermal sensor of Gunther performs the comparison of the temperature value to the reference value to determine the over temperature condition. Hence, the proposed combination would require a change in the principal of operation of the Miller system from an analog based system to a digital based system as well as a change in the basic principal under which the thermal control system of the Miller patent was designed to operate, that is from active polling of temp sensors to read actual temperature values to passive monitoring by waiting for an interrupt indicating an over temperature event. The passive monitoring of a medical device capable of heating to such temperatures that would burn a patient’s skin is a significant change in the principal under which the system of the Miller patent operates and functions.

Applicants claimed invention, in contrast to Miller and Gunther recites a controller for monitoring *die* temperatures of an integrated circuit that includes amongst other features, means for receiving a plurality of first values representative of a plurality of die temperatures of an integrated circuit and means for comparing the plurality of first values to a plurality of corresponding second values representative of a plurality of threshold values. The Miller patent and the Gunther reference lack any teaching or suggestion of a controller for monitoring die

temperatures of an integrated circuit that includes a means for receiving and a means for comparing as recited in Claim 30. Hence, the cited references alone or in combination do not teach or suggest each and every element of Claim 30.

Applicants submit that there is no motivation to combine the references in order to render the claims obvious. In determining whether a case of *prima facie* of obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claim substitution or other modification. The prior art must provide the motivation to make the change to its own teachings to arrive at the invention under rejection. That is, it is not sufficient that the prior art **could be** so modified; instead the prior art must teach or suggest that the prior art **should be** so modified.

It is well settled that to combine references to establish obviousness, one must show some objective teaching in the art of record that would motivate one of ordinary skill to combine the references or a knowledge available to one of the ordinary skill that suggests combining the references. The cited art fails to meet these tests; the cited art lacks facts that suggest combining the references to render obvious Applicants' claimed invention, and the Examiner asserts no such teachings.

To establish a *prima facie* case of obviousness is to present evidence from the prior art that would lead one of ordinary skill in the art to combine the prior art teachings in the proposed manner to obtain the claimed invention. It is not proper to combine prior art teachings where the only incentive to do so is derived from Applicants disclosure.

Applicants respectfully submit that the Examiner has not adequately and sufficiently stated what her motivation is for combining the teachings of the Miller patent with the teachings of the Gunther reference to render the claims obvious. The Examiner merely states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the teachings of Gunther in the invention of Miller in order to provide on-chip temperature control at one or more die locations of an integrated circuit, wherein spurious signals can be dampened out or received for accurate monitoring.

Notwithstanding this statement, Applicants respectfully disagree with the proposed combination. First, the Examiner's statement is merely conclusionary. Second, there is no teaching in either reference that provides a motivation or suggestion to combine the two references to render the claimed invention obvious. The Miller patent is concerned with

avoiding damage to the skin of a patient. Miller is not concerned with monitoring die temperatures of an integrated circuit. Miller is concerned with avoidance of personal injury to a patient. In contrast, the Gunther reference is concerned with the detection of die “hot spots” that cause uneven heating of the die of an integrated circuit.

The temperatures measured by the thermistors of Miller provide no indication of uneven heating of a die packaged in an integrated circuit and, as such, provides no indication of high temperature die locations, or “hot spots” corresponding to die locations experiencing, for example, a high workload. Hence, the thermal system taught by Miller is unable to detect, manage, and control die “hot spots”. The die temperature of an integrated circuit would be of little, if any value, to the system of Miller for the die temperature is not an accurate representation of an external temperature of a plastic or ceramic package that encapsulates the die. Thus, one skilled in the art would not find a motivation or suggestion to combine the teachings of the Miller patent with the teachings of the Gunther reference.

Even assuming *arguendo* that the teachings of the references are properly combinable one would still not be able to construct the claimed invention. As discussed above, the digital thermal sensor of the Gunther reference is not compatible with the controller of the Miller patent for the controller of the Miller patent polls an associated thermal sensor to read an actual temperature value. The digital thermal sensor of Gunther provides a one bit indication of an over temperature event. The thermal sensor of Gunther does not have a structure, operation, or function to respond to a poll request to provide temperature value. In fact, use of the digital thermal sensor taught by the Gunther reference avoids the need for a controller having a structure, operation, and function taught by the Miller patent. That is, the Gunther reference teaches a self-contained digital thermal sensor to make an over temperature determination without the use of a controller external to the thermal sensor.

The prior art does not teach or suggest the claimed controller for monitoring die temperatures of an integrated circuit. Furthermore, because there is no motivation in any of the references for one of ordinary skill in the art to combine the system taught by Miller with the thermal sensor and system taught by Gunther, Applicants submit that the combination of references is in error. Therefore the claimed controller for monitoring die temperatures of an integrated circuit is patentable over the Miller patent and the Gunther reference.

Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 30-32 under 35 U.S.C. §103(a).

B. Rejections of Claims 35-38 under 35 U.S.C. §103(a):

The Office Action rejects Claims 35-38 under 35 U.S.C. §103(a) as being unpatentable over Miller in view of Gunther. Applicants respectfully traverse this rejection on the basis of the following arguments and further content that neither Miller nor Gunther, alone or in combination, teach or suggest each and every element of these claims, as described below, and hence does not detract from the patentability of the claimed invention.

Claims 36-38 depend from independent Claim 35, and therefore incorporates the patentable features of Claim 35.

Claim 35 recites a method for monitoring *die temperatures* of an integrated circuit. The method includes an act of receiving a plurality of first values representative of a plurality of *die temperatures* of the integrated circuit. The method further includes acts of comparing the plurality of first values to a plurality of corresponding second values representative of a plurality of threshold values and determining whether an over temperature condition of the integrated circuit exists based on the act of comparing.

The Miller patent describes a thermal management system for a portable ultrasound imaging device. The thermal management system of Miller includes a number of temperature sensors, preferably thermistors to monitor respective case temperatures of the components forming the portable ultrasound imaging device. A thermal management controller periodically polls the temperature sensors during operation of the ultrasound imaging device according to a software polling routine stored in the thermal management controller. The thermal management system of Miller monitors the respective case temperatures of various system components, for example, a battery, a fan, and external surface of an encapsulating package that surrounds the *die* of the integrated circuit, and based on the monitored temperatures, performs a control methodology to cool the ultrasound system to maintain an external casing temperature below a critical mandatory temperature. Maintaining the external casing temperature of the ultrasound device below the critical mandatory temperature avoids burning the skin of a patient when skin contact occurs with the ultrasound head of the imaging device.

It is recognized by the Examiner, that the Miller reference does not teach or suggest a step of receiving a plurality of first values representative of a plurality of *die* temperatures of an integrated circuit, as recited by Claim 35. The Examiner looks to the Gunther reference to cure the factual deficiency of the Miller patent in determining that the claims are obvious. The Gunther reference teaches a thermal management system that includes a digital thermal sensor that provides an indication of an over temperature event. That is, the digital thermal sensor taught by the Gunther reference has a single bit output that has one of two states. One state indicates the crossing of a threshold in one direction and the other state indicates the crossing of the threshold in the opposite direction. Moreover, the controller of the thermal system taught by Gunther does not compare a plurality of first values to a plurality of corresponding second values representative of a plurality of threshold values. The value received by the controller of Gunther represents the occurrence or the non-occurrence of an over temperature event.

Applicants submit that there is no motivation to combine the references in order to render the claims obvious. In determining whether a case of *prima facie* of obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claim substitution or other modification. The prior art must provide the motivation to make the change to its own teachings to arrive at the invention under rejection. That is, it is not sufficient that the prior art **could be** so modified; instead the prior art must teach or suggest that the prior art **should be** so modified.

Applicants respectfully submit that the Examiner has not adequately and sufficiently stated what her motivation is for combining the teachings of the Miller patent with the teachings of the Gunther reference to render the claims obvious. The Examiner merely states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the teachings of Gunther in the invention of Miller in order to provide on-chip temperature control at one or more die locations of an integrated circuit, wherein spurious signals can be dampened out or received for accurate monitoring.

Notwithstanding this statement, Applicants respectfully disagree with the proposed combination. First, the Examiner's statement is merely conclusory. Second, there is no teaching in either reference that provides a motivation or suggestion to combine the two references to render the claimed invention obvious. The Miller patent is concerned with heat generated by ultra sound device to prevent an external casing surfacing temperature of an ultra sound head



from increasing beyond a critical mandated temperature to avoid damaging a patient's skin. Miller is not concerned with monitoring die temperatures of an integrated circuit. Miller is concerned with avoidance of personal injury to a patient unlike Gunther which attempts to solve a problem with die "Hot Spots".

The prior art does not teach or suggest the claimed method for monitoring die temperatures of an integrated circuit. Miller does not teach or suggest monitoring of die temperatures and Gunther does not teach or suggest the step of receiving, the step of comparing and, the step of determining as recited in Claim 35. Furthermore, because there is no motivation in either reference for one of ordinary skill in the art to combine the thermal management system of Miller with the thermal management system of Gunther, Applicants submit that the combination of references is in error. Therefore, the method for monitoring die temperatures of an integrated circuit as recited in Claim 35 is patentable over the Miller patent and the Gunther reference. Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 35, 36, and 38 under 35 U.S.C. §103(a).

C. Rejection of Claims 33 and 34 under 35 U.S.C. § 103(a):

The Office Action rejects Claims 33 and 34 as being unpatentable over Miller in view of Gunther and further in view of U.S. Patent No. 5,291,607 of Ristic, *et al.* (hereinafter "Ristic"). Applicants' respectfully traverse this rejection on the basis of the following arguments, and further contend that neither Miller nor Gunther nor Ristic, alone or in any combination, teach or suggest each and every element of these claims, as described below and hence, does not detract from the patentability of the claimed invention.

Claims 33 and 34 depend, directly or indirectly from Claim 30 and thereby incorporate the patentable features of Claim 30.

The Ristic reference discloses a microprocessor having a monolithically integrated environmental sensor. The microprocessor of Ristic is shielded from an environmental signal by means of isolation which is specific to the type of sensor used, thereby allowing the sensor to be exposed to an environmental signal.

Nonetheless, the Ristic reference fails to teach or suggest a controller for monitoring die temperatures of an integrated circuit that includes, amongst other features, a means for receiving a plurality of first values representative of a plurality of die temperatures of an integrated circuit.

The Ristic patent is concerned with a microprocessor shielded from the integrated environmental signal produced by the integrated environmental sensor to allow the sensor to be exposed to the environmental signal. The Ristic patent is not concerned with a controller for monitoring die temperatures.

Ristic like Miller and Gunther fails to teach or suggest a *controller* for monitoring die temperatures of an integrated circuit that includes means for receiving a plurality of first values representative of a plurality of die temperatures of an integrated circuit and means for comparing the plurality of first values to a plurality of corresponding second values representative of a plurality of threshold temperatures. Hence, neither Miller nor Gunther nor Ristic, alone or in any combination, teach or suggest each and every element of Claims 33 and 34, and therefore fail to establish a *prima facie* case of obviousness. Accordingly, Applicants' respectfully request the Examiner to reconsider and withdraw the rejection of Claims 33 and 34 under 35 U.S.C. § 103(a).

#### **CONCLUSION**

In view of the remarks set forth above, Applicants contend that this application is in condition for allowance. If the Examiner deems there are any remaining issues, we invite the Examiner to call the undersigned at (617) 227-7400.

Respectfully submitted,

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Dated: December 20, 2004